AEROTECH RESEARCH (U.S.A.), INC.

The Evaluation of a Prototype Turbulence Auto-PIREP System

4th Weather Accident Program Review
June 3, 2004

Dr. Paul Robinson

Development Goals

To develop a system to generate real-time, automatic reports of hazardous turbulence events, and display the information for improved operations around turbulence.

Key Users

- Flight Crews
- Dispatchers
- Maintenance

Desired System Attributes

- Intuitive and clear displays.
- Consistent with other turbulence hazard information.
- Event driven report generation.
- Hazard severity scalable for different aircraft.
- Augments current decision-making aids.
- “Near” real-time.

Program Organization

NASA

Programmatic oversight & funding

AeroTech

TAPS technical development & implementation

ARINC

Communications handling

Groundstation software package

Delta Air Lines

Aircraft platforms and crews

Operational guidance

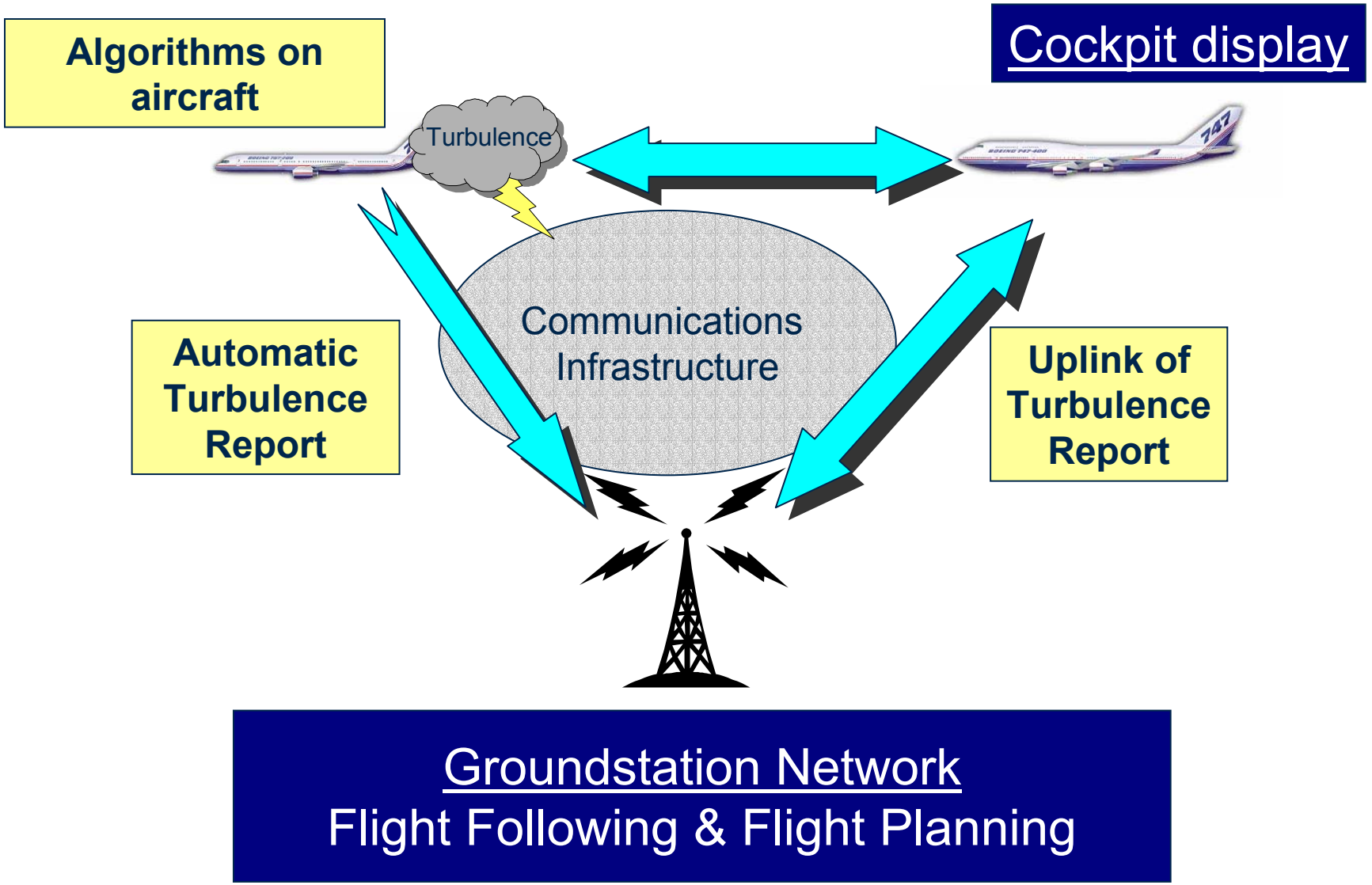
Flight data

Delta Air Lines' Requirements Summary

		Engineering					
		Maintenance	Enabling Technologies	Flight Safety	Flight Ops	Dispatch	Meteorology
aircraft databus parame	time	✓		✓	✓	✓	✓
	altitude	✓		✓	✓	✓	✓
	lat	✓		✓	✓	✓	✓
	long	✓		✓	✓	✓	✓
	weight	✓		✓		✓	
	TAS	✓		✓			
	OAT			✓		✓	✓
	wind speed			✓		✓	✓
	wind direction			✓		✓	✓
calculated paramete	σΔn	✓		✓	✓	✓	✓
	σΔn (m. r.)						
	peak +ve Δn	✓		✓			
	peak -ve Δn	✓		✓			
	peak ay	✓		✓			
	turb. scaling parameter				✓	✓	
	turb. encounter data files		✓				
	real-time processing	✓		✓	✓	✓	✓
	post-flight analysis		✓				

Included in TAPS packet

TAPS Overview



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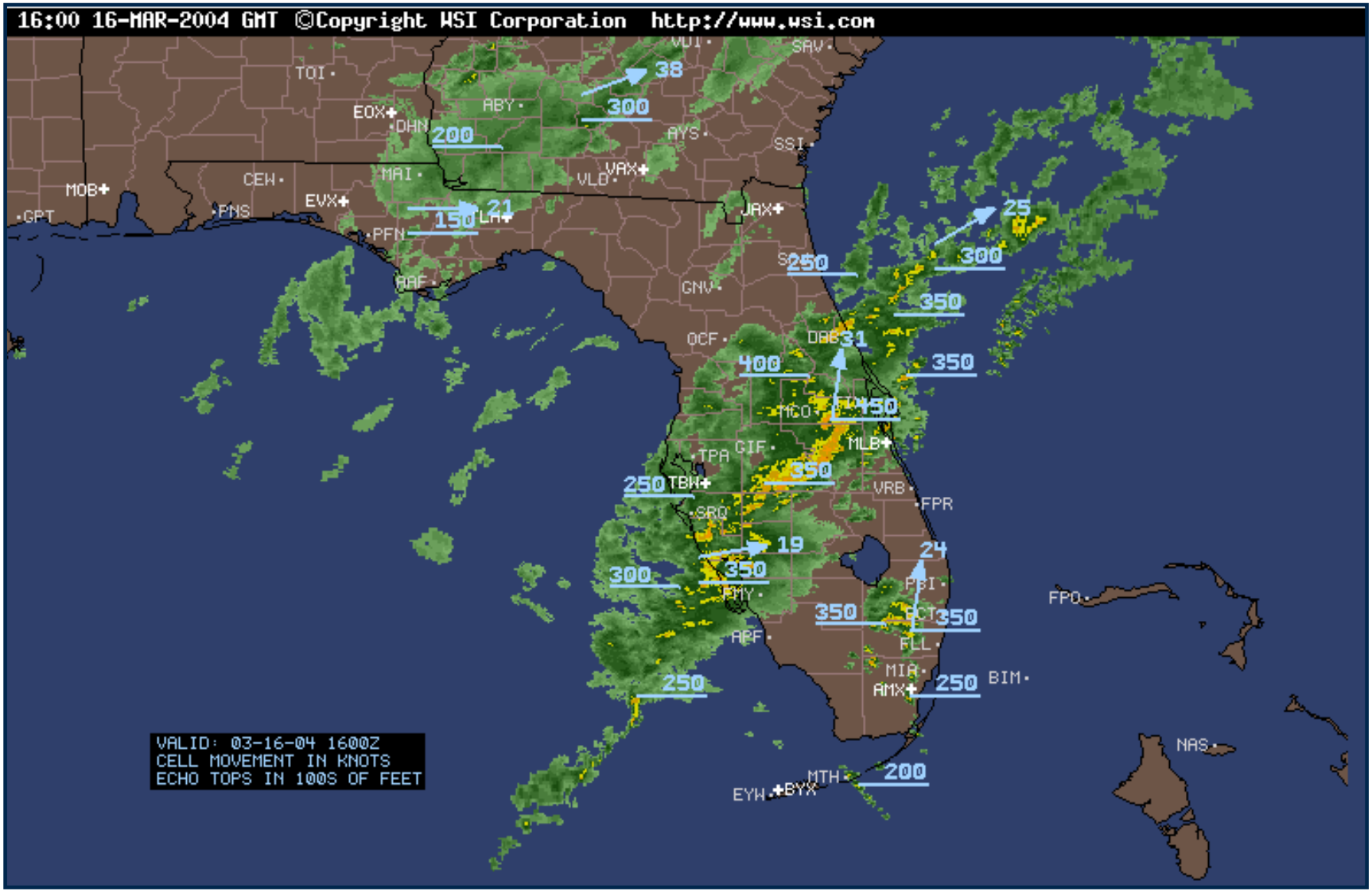
Example Scenario: 3/16/04



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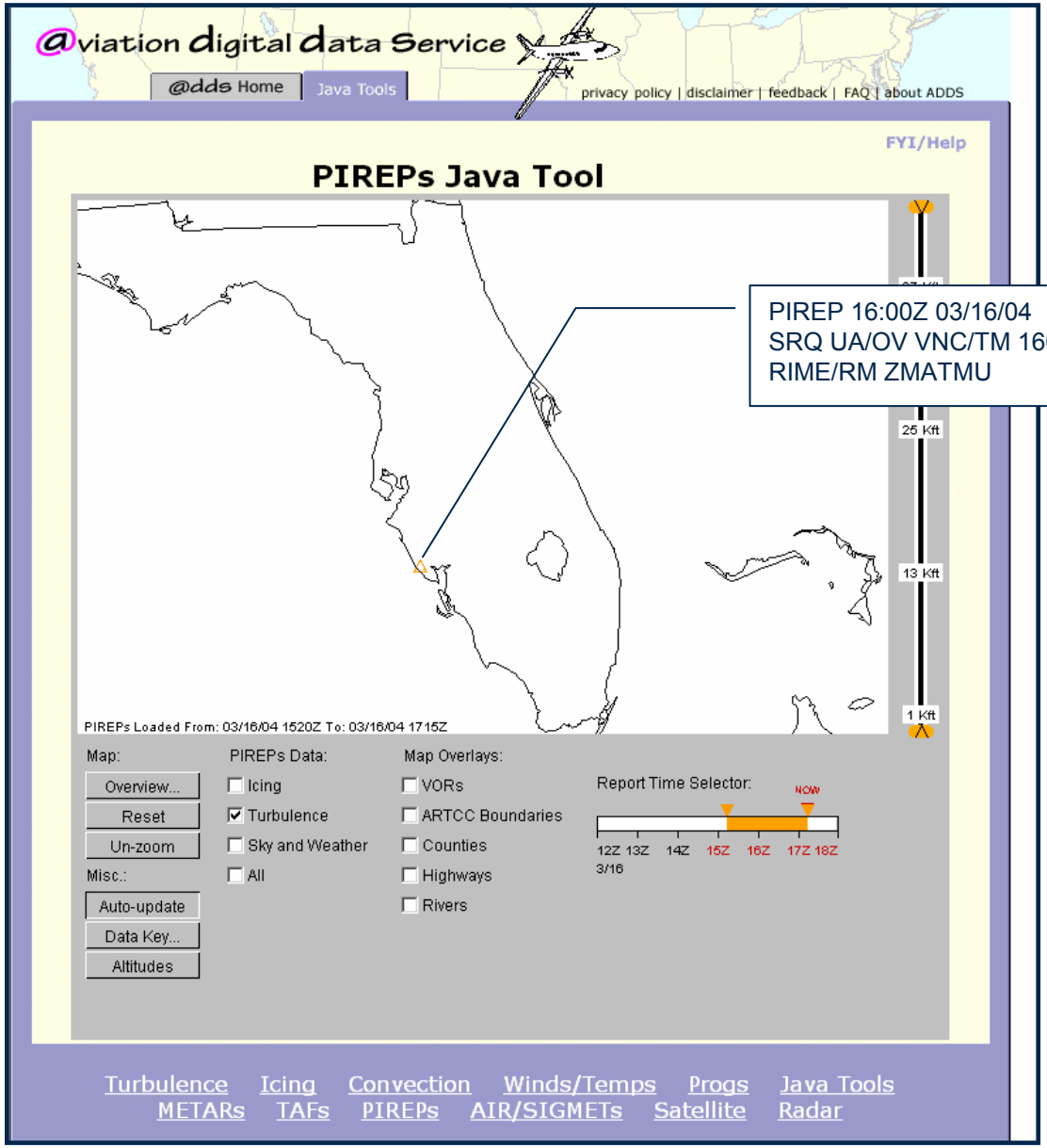
Example Scenario: 3/16/04



PIREP 16:00Z 03/16/04
SRQ UA/OV VNC/TM 1600/FL170/TP B190/TB LGT-MOD/IC MOD
RIME/RM ZMATMU

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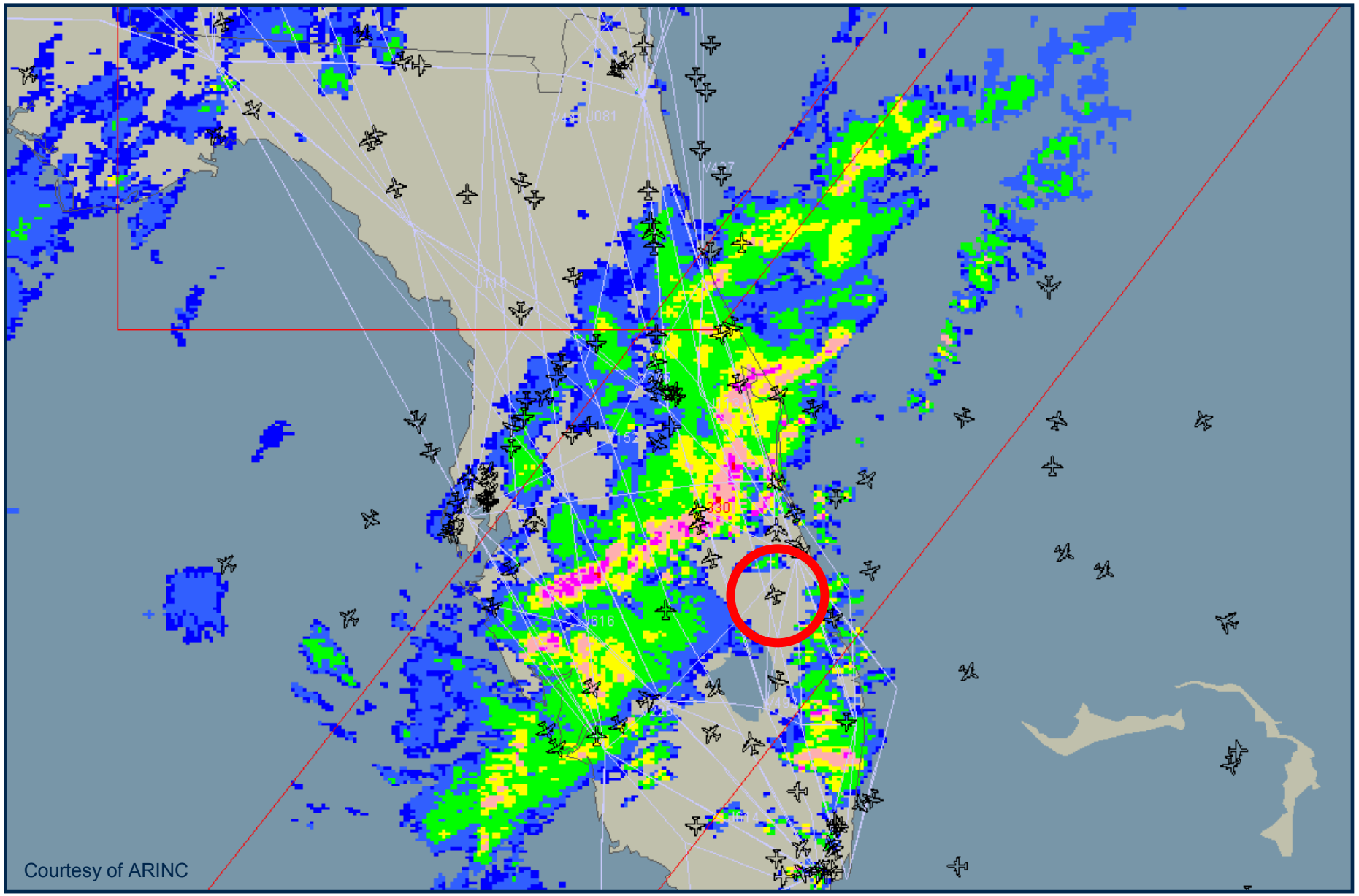
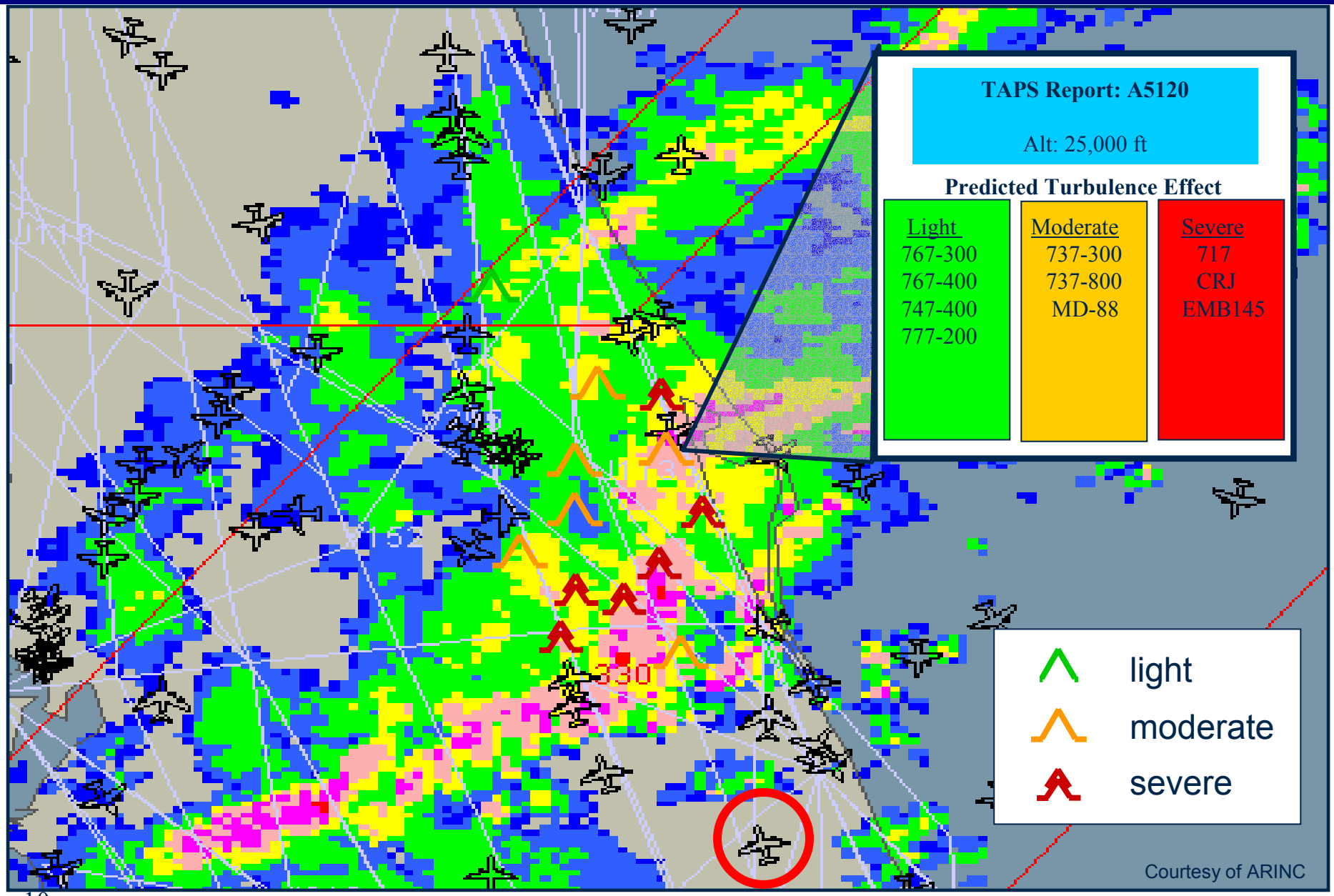
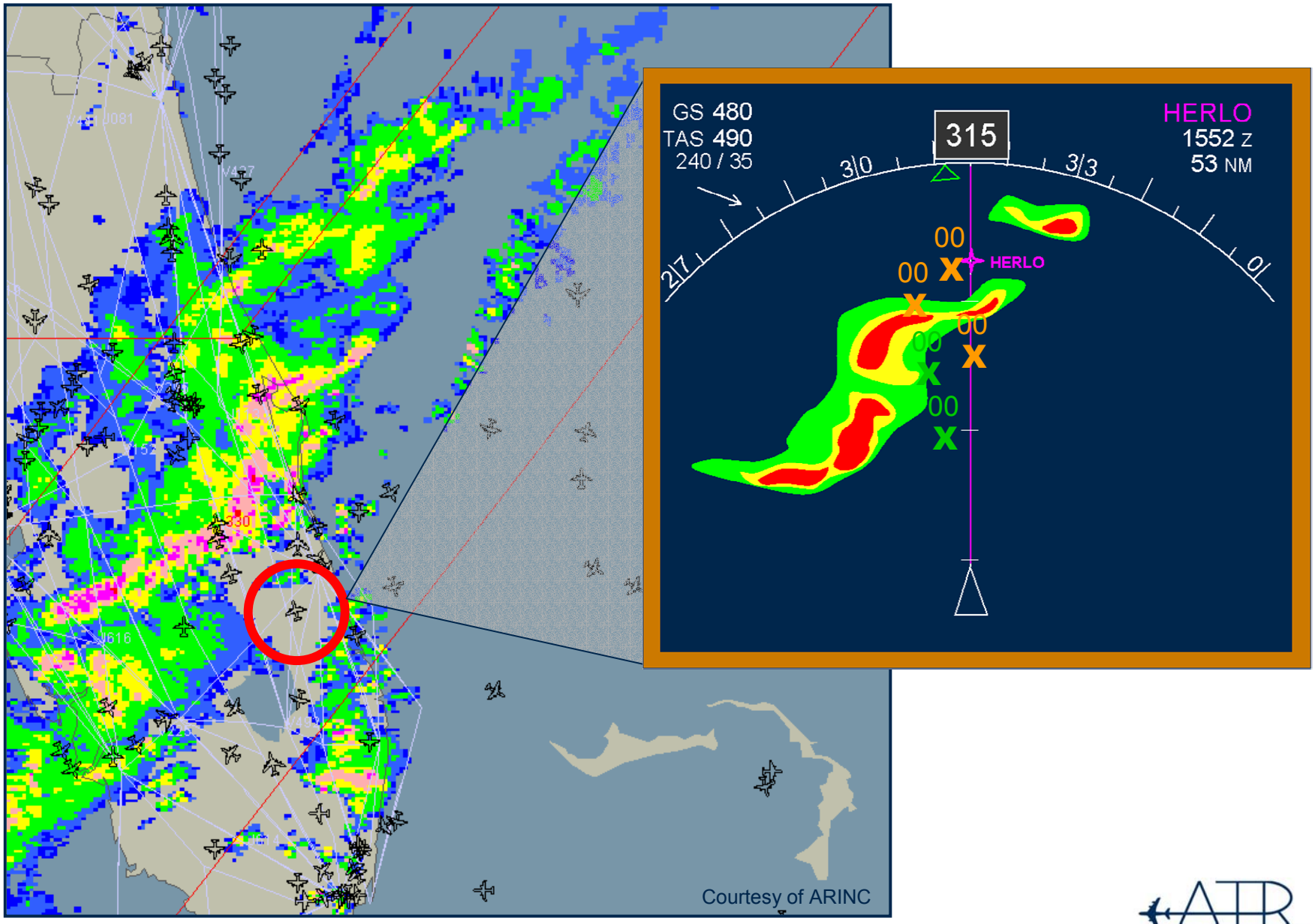
Example Scenario: 3/16/04



Flight Following Display Concept



Cockpit Display Concept



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Year 1: TAPS Groundstation Implementation

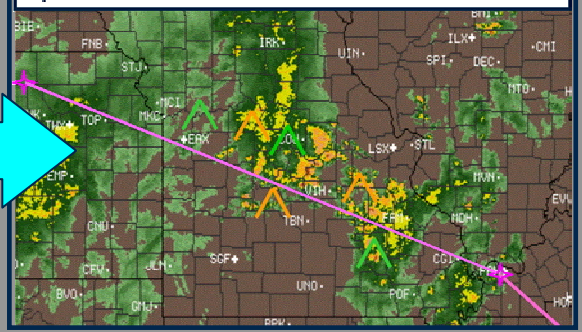
Reporting algorithms implemented on aircraft

Turbulence reports made to ground

Reports received and relayed to groundstation via ARINC network

Scaling & Interface

Type:	B 777-200
Weight:	575,000 – 600,000 lbs
Alt:	FL 310
Speed:	M 0.82



TAPS Groundstation

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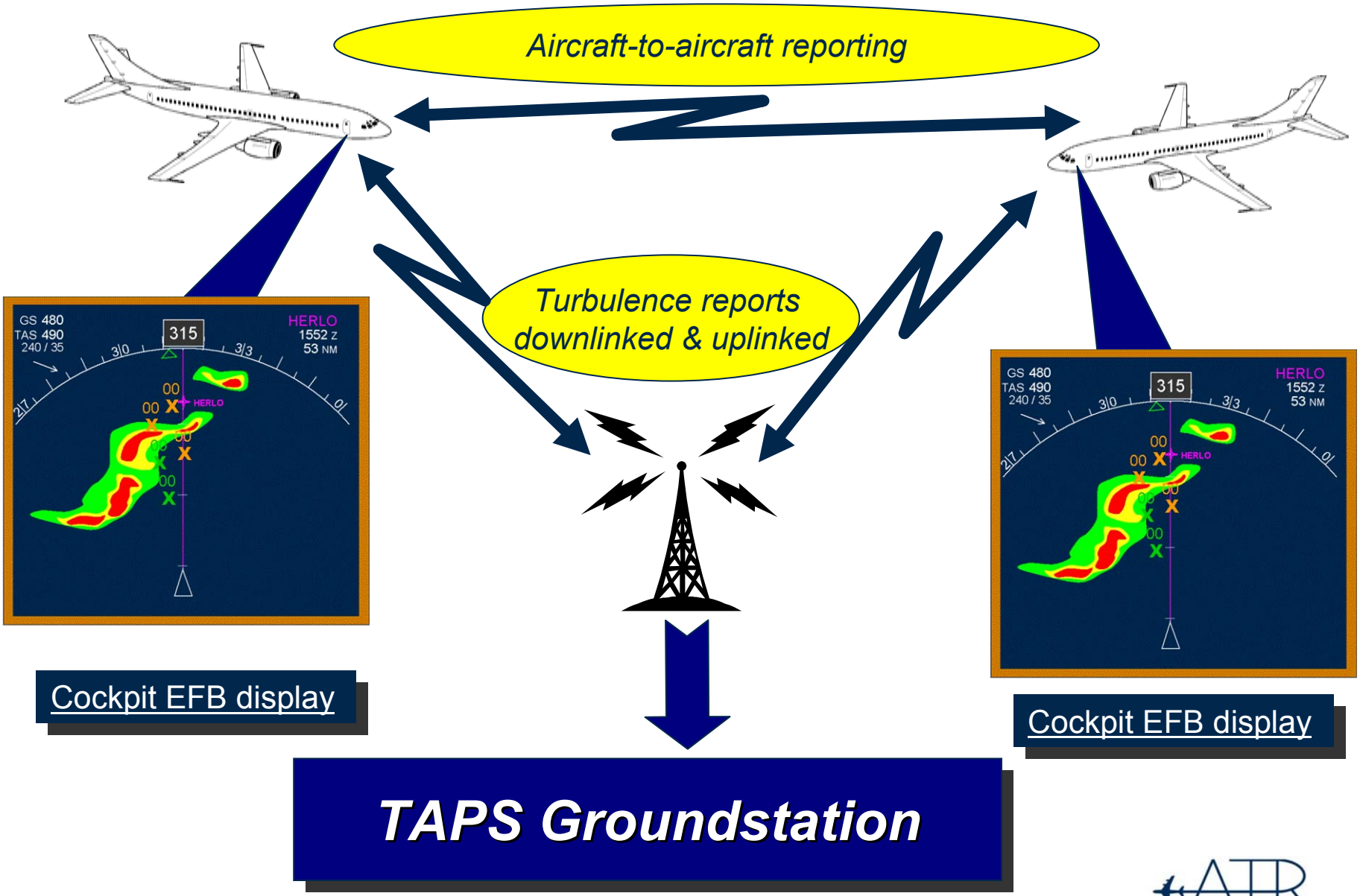
Year 2-3: Cockpit Implementation



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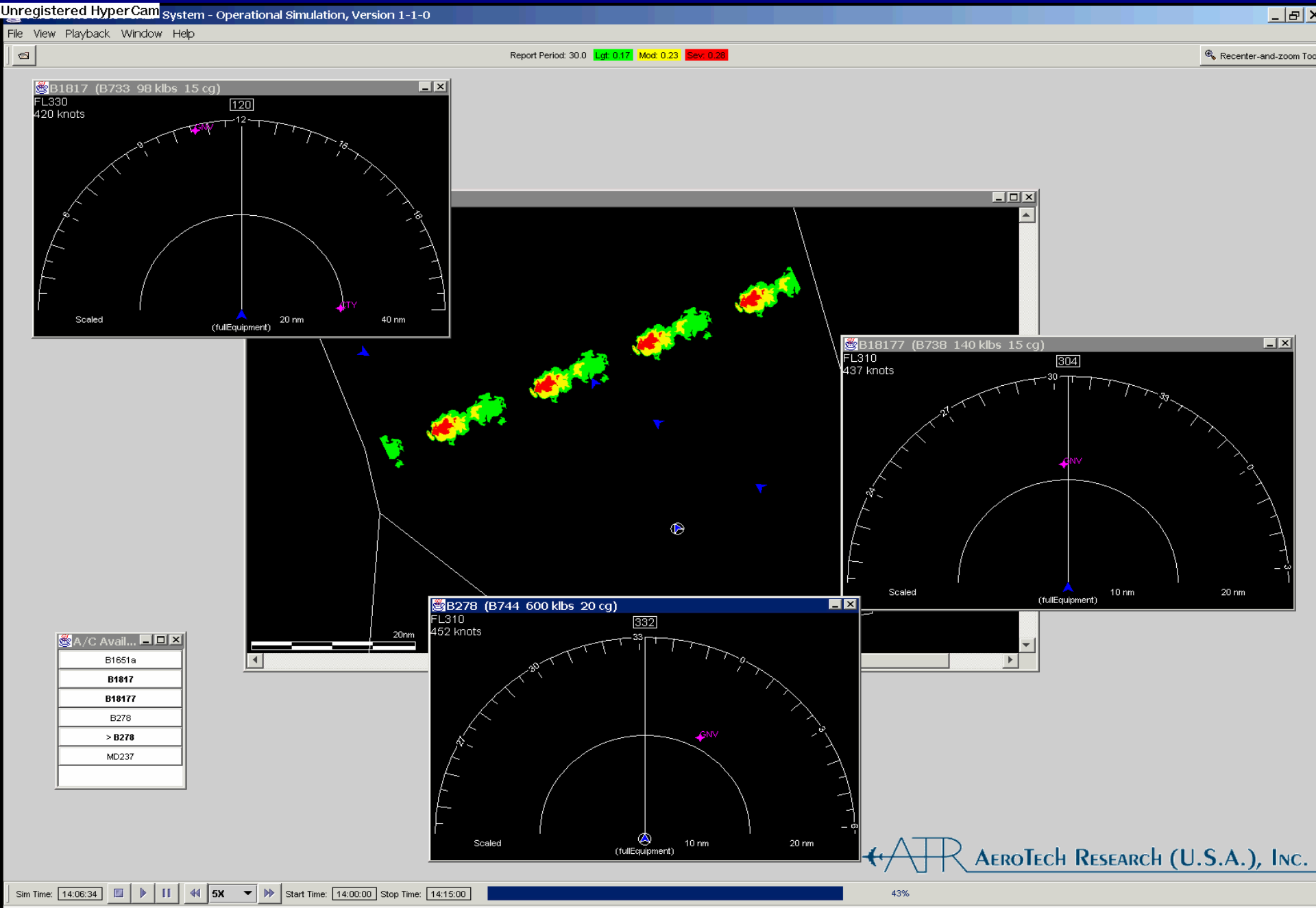
Accomplishments to Date

- Work started in TPAWS in October 2001.
- FY-02 flight test – single aircraft:
  - Reporting logic test
  - Communications test

NASA LaRC B-757 Research Aircraft

- Planned FY-03 two-aircraft flight test – cancelled.
- Developed collaborations with airlines for TAPS evaluation.
- Developed TAPS Operational Simulation (TAPOS) for:
  - System studies
  - Display development
  - Interface development
  - User feedback and refinement

Display Development Simulation



Schedule & Key Milestones Overview

Preliminary design review	March	2004
Implementation document delivered	March	2004
Installed on 71 Delta B-737-800's	August	2004

FY-05

- Data stream verification
- Concept of operations validation
- Part- & full- task simulations
- Cockpit & ground display development